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ABSTRACT

Semantic theory, its relationship to comprehension, the nature and function of semantic memory, and results of some research on semantic memory and bilinguals are discussed through a review of recent literature. The findings discussed seem to confirm these general observations regarding semantic memory and bilinguals: (1) there is integration and storage of semantic information from various modalities in memory; (2) one semantic memory exists in bilinguals with labels from each of the language systems; (3) the preferred processing strategies of early bilinguals for verbal stimuli are analytic and semantic; (4) vocabulary items from different languages are closely and automatically connected in semantic memory, and the bilingual can turn off his nonactive language; (5) bilinguals process semantic memory information in the same way in their two languages in the same manner as monolinguals; and (6) semantic relationships between words in different languages influence tasks involving secondary memory. Semantic memory in bilinguals remains a challenging research topic, since there is much more to learn. (MSE)

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Semantic Theory, Comprehension, and Bilingualism

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Semantics is the study of meaning which highly complex cerebral mechanisms are able to abstract from a series of utterances be they words, phrases, or clauses which have been communicated to the listener by the speaker in given situational and social contexts. This meaning or series of meanings are then stored in semantic memory for retrieval and use in similar or diverse communication situations. Katz and Fodor (1963) studied semantics and suggested that a semantic theory should be able to describe three things: the dictionary, semantic rules, and semantic interpretations. Once the individual has partially interpreted the meanings of single words, he should be able to derive the meanings of sentences through the use of semantic rules and semantic interpretations. (1)

Semantic features are extremely helpful to the human brain for they present more information about a given word than the dictionary entry itself. They indicate to the researcher and to the speaker those features or characteristics shared by the senses or interpretations of a given word.

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Semantics is intimately related to the study of comprehension, for it is through this intellectual activity that we understand what is communicated to us. Comprehension may be considered as psychological processes consisting principally of two cerebral operations: a) the encoding of information into internal representations; and b) the comparing of these representations. These opera-

tions process linguistic information from the moment that nerve cells called neurons convey auditory, visual, and various sensory inputs to the brain to the time when the listener compares the internal representation.(2) The listener becomes an information processor capable not only of processing linguistic information but also of presenting it to the brain as determined by internal linguistic structures as deep structure and semantic memory. These activities assume that there is a relationship between the linguistic system and the neurological system in man the nature of which is unclear.

Semantics begins with the learning and understanding of individual lexical items. When a person studies and gradually masters a vocabulary, he acquires a wealth of information related to it. This information may relate to the spelling of the word, its pronunciation, etymology, syntactic category, and inflected forms. An unabridged dictionary will provide such information as well as phrases suggesting different meanings, sentences illustrating its use, comments on the use of nearly synonymous words, and, in some instances, even pictures or tables where appropriate.(3) The definitions of such words allow the speaker not only to learn the meaning of such lexical items but to establish conceptual relations with other words thereby broadening the semantic repertoire related to a particular word.

The vocabulary which an individual has learned may be considered as his "mental lexicon". It may be thought of as a fixed data base which can be utilized by active elements of the language

processing system. As the speaker uses vocabulary to communicate with others, he must employ certain grammatical patterns ordered in a particular sequence imposed by the language he is using. This is the linguistic context. In it, words place certain constraints or limitations on each other as they appear in phrases and sentences.

Besides the linguistic context, the speaker deals with the situational context, that is, the role that situations play in the acquisition of lexical concepts. This would be particularly true in the case of spoken language but not so in written language. This is not to infer that written language is free of situational context. As Ringle (1982) explains: "Written language is largely parasitic on situational conventions established in spoken language; these conventions are imported in written language either explicitly (as in the case of narrative) or implicitly (as in the case of letters of speeches)."(4)

Finally, there is the intentional context. This means that prior to comprehending what has been communicated by the speaker, the listener must know something about the intention of the speaker. This enables the listener to make appropriate inferences with respect to the vocabulary of the speaker as well as his purposes and beliefs. If the listener is unfamiliar with the purposes or beliefs of the speaker, then he may not be able to understand what the speaker is attempting to convey.

These three contexts - linguistic, situational, and intentional - are integral elements in the lexical semantic acquisition process of

the speaker. He relies very strongly on words and their meanings, as well as on phrases, clauses, and sentences. Words are basicly important and when one considers word meaning he distinguishes four aspects: a) referential; b) denotative; c) associative, and d) affective. Each of these refers to a different component of meaning or a different aspect of a person's reaction to a word. Glucksburg and Danks (1975) have provided a very comprehensive definition of word meanings:

> The set of possible meanings of any given word is the set of possible feelings, images, ideas, concepts, thoughts, and inferences that a person might produce when that word is heard and processed. This implies that word comprehension, like speech perception, is an active constructive process that is highly sensitive to both linguistic and social-physical contexts.(5).

The referential component of the meaning of a word is the particular object, event or relationship specified by a word. It is specific and not generic, and depends to a great extent on the context. Unless this is known, it is very difficult if not impossible to establish what a particular word refers to.

The denotative meaning of a word is the generic idea which that word represents. A denotative relationship can be established among words through some type of classification system demonstrating the concepts which those words show.

The third aspect is the associative meaning of a word and is interpreted to be "the sum total of all the things a given person thinks of when he hears the word. This kind of meaning - the pattern of responses to a word - is somewhat similar to denotative meaning but is far less systematic." (6) Word associations are created in

the brain reflecting a knowledge of the language and of the world. Adults reveal word association patterns which appear to be rather homogeneous and predictable and are somewhat different from children's which are rather varied.

Finally, the fourth aspect of word meaning is the affective dimension. This relates to the feeling which the speaker or listener displays about a particular concept. Fear, love, hate, may be some of the emotions which accompany the descriptions of meanings of certain words. Because of their nature, emotions have a tendency to influence the word meaning in a rather subjective manner.

In the process of mental abstraction of concepts and meanings, one often deals with semantic memory, a term used very frequently, and which has been defined as:

> a mental thesaurus, organized knowledge a person possesses about words and other verbal symbols, their meanings and referents, about relations among them, and about rules...for the manipulations of these symbols, concepts, relations. (7)

Semantic memory stores a repertoire of mental representations or images of words and the many features associated with them including their meanings. For this reason, it is stated that memory is a semantically based system. After the listener has abstracted meaning from a syntactic structure, memory discards the structure since it no longer appears to serve a useful purpose.

The nature and function of semantic memory has been a topic of considerable interest among researchers. Norlin (1980) reviewed studies of information retrieval by adult subjects and concluded that the process of lexical semantic storage and retrieval required two elements: a) lexical nodes (either words or concepts) and 2)

arcs encoding relations which would link these nodes. He interpreted the meaning of an individual word to consist of a unique constellation of other lexical nodes, each connected to the target word by a particular relational arc. He hypothesized that the growth of a lexical semantic system implied the ability to join appropriate lexical items using a variety of these relational arcs. He concluded that the active construction of certain types of relationships with words appeared to be at the basis of lexical and syntactic semantic development.(8) He experimented with forty eight children, twelve each at ages three, four, five, and six years by asking them to define and describe ten concrete nouns with no attendant visual stimuli. The responses revealed nineteen different semantic relationships in the definitions presented, and exceptional differences were observed between the age levels in the several arrangements of semantic relational categories appearing in the first five relations obtained from each child by each noun. Norlin's findings suggested that the knowledge about word meaning contributed by the children through their definitions and descriptions might also be a clue to the development of lexical semantic memory structure. The definitions and descriptions furthermore provide the contextual frames in which the lexical items are stored and demonstrate certain characteristics from long-term semantic memory storage which must be infered from single-word associations.(9)

Figueroa, González, and Solís (1976) studied the problem of meaning and observed how the meaning of a word is embedded in its relationships with others in memory. The role played by memory is one of an active reconstructive process which recovers information

which has been stored. Memory's selective processes determine the quality of response thereby establishing some limitations on the type of data that are used to formulate the response. According to the researchers, the semantic network of a concept is created by the concepts organized in memory and the elements of the network are based on their class and properties and not on the strength of their association.(10)

Nagata (1981) studied semantic relations as they are influenced by word order and grammatical markers. Using an artificial linguistic system, he analyzed the effectiveness of word order and grammatical markers as syntactic indicators of semantic relations. The reason for the use of word order and grammatical markers was that they are two of the most used syntactic devices to express semantic relations in natural languages. The results of the experiment indicated that semantic interpretation was possible for subjects given fixed word order sentences with or without markers as well as for subjects given the markers in random word order sentences. The results also revealed that word order was more efficient than grammatical markers as clues to semantic relations and that the critical condition for the acquisition of language was the constant covariation of linguistic structure with semantic or referential context.(11)

The nature of semantic development in children was studied by Donaldson and McGarrigle(1973). The subjects of the experiment were 40 pre-school children between the ages of three and five and of different socioeconomic backgrounds. The tasks assigned to the subjects were similar to conservation tests in that a judment was

elicited from the child initially, a change introduced which was irrelevant, and a judgment elicited again. Some of the children changed their judgments when faced with the irrelevant changes. The children did not interpret the questions in ways consistent throughout the testing. The researchers obtained evidence suggesting that children utilize three kinds of rules: lexical rules, syntactic rules, and local rules. Lexical rules relate to the meanings of individual words and are not finely specified. They place few limitations on the interpretation to be given the utterance. Syntactic rules also impose few limitations when compared to the constraints placed on adult interpretation. Local rules interact with lexical and syntactic rules in ways which are vital to the interpretation of utterances. They help to determine those features of the referent to be chosen as criteria for assigning truth values when the linguistic rules leave the matter vague.(12) They are called local rules because they relate with the circumstances locally existing which permit an utterance to be interpreted in one way or another.

Harris (1974) researched another semantic relationship within a language system, that of inclusion or hyponymy, which is important for semantic memory. Its importance lies on the fact that it permits economy; thus, if there are several terms which are stored in subordinate relationship, then common attributes to those terms may be stored singly with the superordinate rather than multiply with a large set of subordinates. In his experiments with children between the ages of 5 and 7, Harris demonstrated that nominal predication of an unknown word by a superordinate term enabled young children to make appropriate inferences concerning its

attributes. The investigator concluded that:

> young children can draw reasonable inferences about an entity which has been defined by simple predication. They infer that the entity, so defined, possesses attributes common to members of the superordinate category and lacks attributes which are not possessed. Secondly, subjects have an implicit notion of a class and its members. Thus, although a member is assumed to have the attributes of its class, it is not identified with other members of its class unless it shares the appropriate distinguishing attributes. (13)

De Villiers and de Villiers (1972) experimented with two and three year old children in a game played with hand puppets. Their purpose was to study early judgments of semantic and syntactic acceptability by children. The type of sentences used was simple imperatives and each of the children was asked to correct those he called "wrong". All the children in the study were able to correctly act out reversible active sentences. Three of the four children who were unable to make correct judgments of reversed order imperatives were overgeneralizing the active sentence order when asked to act out a reversible passive sentence. The findings of the researchers indicated that preservation of appropriate word order in spontaneous speech and the use of word order information in comprehension occur well before the ability to make metalinguistic judgments of correct and reversed word order. Of major importance to psycholinguistic research was the finding that correct judgments and corrections of semantic anomaly could be elicited from children who were unable to make correct judgments of syntactic acceptability. This judgment method may provide an insight into the early semantic development of the child. (14)

The flexibility of semantic memory permits a person equal facility in the recognition of active sentences and passive sentences.

James and Abrahamson (1977) obtained data from three experiments in which recognition memory for active and passive sentences was compared. The findings indicated that there was no storage advantage for active over passive sentences, observing that the advantage usually noted on recall experiments is the result of reconstructive processes. The authors observed: "We feel that our data place an important restriction on theories of syntactic memory:viz.," that the psychological representation of a passive sentence not be more complex than that of an active sentence." (15)

Thus far, the discussion has focused on semantic theory, comprehension, and the nature and function of semantic memory as described in the findings of a number of researchers. Let us turn our attention now to the linguistic phenomenon known as bilingualism and semantic memory. The question that has frequently been raised is whether a person who speaks two languages has a single semantic system or whether there is a separate system for each language. Rosenberg and Simon (1977) explored the integration and storage of semantic information from various modalities in memory. They were interested in finding out whether related ideas in French and English, or in pictures and sentences, resulted in a single representation in memory or were two modality-dependent ones. Items containing different modalities were presented to the subjects who were then asked if subsequently presented items were or were not identical with the former ones. The results indicated that pictures and sentences had very similar semantic systems, perhaps the same semantic system, underlying them. The subjects showed evidence that they had similar systems for both pictures and sentences. They expressed

confusion as to whether they had seen a picture or a sentence which revealed the same meaning because they integrated a list of related sentences and pictures. The researchers concluded that the bilingual subjects had very similar, if not identical, semantic systems for English and French and that they integrated information across modalities into a single underlying semantic representation. (16)

Vaid and Lambert (1979) studied the cognitive processing strategies of two groups of French-English bilinguals through the use of an auditory Stroop test designed to evaluate cerebral hemispheric involvement. An area of interest to the researchers was the age of onset of bilingualism since this appears to be a distinguishing factor between groups of bilinguals according to findings of behavioral and neurobehavioral studies. Those who become bilingual at infancy seem to utilize an analytic, semantic approach to the processing of verbal material whiel those who acquire bilingualism during their adolescence use an approach to language processing which relies on extralinguistic features of language stimuli. Therefore, Vaid and Lambert examined the processing strategies of early and late bilinguals, as well as the sex variable in the lateralization context. The findings suggest that the preferred processing strategy of early bilinguals is primarily semantic. They indicated that the onset of bilingualism was an important factor which influenced one's approach to verbal information and the involvement of the two hemispheres. The conclusions support the belief that the processing strategy used by early bilinguals versus late bilinguals for

both of their languages relied more on the left hemisphere versus the right hemisphere. Females seemed to rely less than males on the left hemisphere in their analysis of meaning of verbal stimuli.(17)

Ehri and Ryan (1980) conducted a study related to the storage and accessibility of words in the semantic memory of Spanish-English adults. The picture-word interference task was administered because it permits a more general examination of the bilingual's lexical storage and retrieval since the vocabulary used is not limited to color words. This method includes a comparison of the times taken to name a series of pictures with and without distracting words printed on the pictures. The purpose of the study with the Spanish-English bilingual adults was to determine whether the same lexical access processes of bilinguals in the color-word task also underlie and account for performance in the picture-word interference task. If bilinguals were to keep their lexicons separate during picture naming, then distractor words in the same language as the requested picture names would create substantial interference whereas distractor words in the nonactive language would produce very little interference. In the event that there were intermixing of the two languages in semantic memory, words from both languages would produce substantial and equivalent interference. Pictures were presented with Spanish words naming other objects, with English translations and with X's. Spanish and English distractor words contributed to slow down picture naming in both languages. On the first trial, Spanish words produced more interference than English words although the pattern was reversed after that.

The findings by Ehri and Ryan revealed that bilinguals suffered substantial interference from printed words in a picture-naming task whether the names of the pictures and the words came from the same or different language. This would indicate that vocabulary items from different languages are closely and automatically connected in semantic memory and tnat the bilingual cannot turn off his nonactive language. Greater intra than inter-lingual interference was noted among bilinguals naming pictures in English. This would seem to indicate that "the lexicon of a bilingual is integrated but that the distance between two words within a single language is less than the distance between one of the words and a translation of the other word across languages in semantic memory."(18)

Caramazza and Brones (1980) studied semantic classification by bilinguals. They conducted two experiments designed to test whether bilinguals had shared or separate semantic memory representations for their two languages. The subjects were ten Spanish-English bilinguals from the Johns Hopkins University who volunteered for the experiment. All subjects were native speakers of Spanish who ranged in their self-ratings of bilingual fluency from good to excellent. The experimental task utilized in both of the experiments called on the subjects to determine as quickly as possible whether a noun belonged to a particular category. The words in each category-instance pair could be either from the same language (e.g. furniture-chair) or different languages (e.g. furniture-silla). No effects of language condition (same/different languages) were obtained in either experiment. The authors concluded that the pattern of significant effects

obtained for typicality and distance dimensions suggested that bilinguals processed semantic memory information in the same way in their two languages and in the same way as monolingual speakers. There was nothing to suggest that speakers of two languages had separate semantic memory representations for each of their languages. Thus, it was appropriate to conclude that bilinguals had a single semantic representation serving two distinct sets of lexical entries for the two languages.(19)

Kintsch and Kintsch (1969) did research on interlingual interference and memory processes in eight bilingual subjects. The first language of four of the subjects was American English and they were either students or instructors at the University of California at Riverside who had lived at least nine months in a German-speaking environment. The other four subjects spoke German as their first language and had lived in the United States for various periods over nine months. All of the subjects had originally learned their second language in school. The bilingual subjects learned eight-item paired-associate lists with four English and four German words as stimuli and the digits 1-8 as responses. Four translated word pairs were used as stimulus terms for Experimental lists and unrelated words were used for Control lists. In the first experiment, performance was retarded when translated word pairs were used in a rote learning task which mainly involved secondary memory. The researchers assumed that paired-associate learning was dependent on secondary memory processes and that the meaning of a particular word was a relevant factor for storage in secondary memory. Consequently, semantic

similarity was expected to retard pair-associate learning. Interlingual interference was observed in that the Experimental lists were harder to learn than the Control lists.In the second experiment, the probe lists were recalled equally well regardless of experimental conditions. The semantic relationship between translated word pairs did not produce interference in this task; that is, it did not influence the performance of the subjects, probably because they responded to the sound of the words rather than to their meaning. This is characteristic of primary memory storage in which the sound of a verbal item is retained for a short period of time. The authors concluded that semantic relationships between words in different languages influence tasks involving secondary memory. Furthermore, there was no interlingual interference in a second learning situation which depended mostly upon primary memory. (20)

Tulving and Colotla (1970) experimented with free recall of trilingual lists by six subjects all of whom were proficient in English, French, and Spanish, and most spoke one or more other languages. These speakers had to recall unilingual, bilingual and trilingual lists. The researchers found that recall of words from primary memory was identical for unilingual and multilingual lists; 2) that recall of words from secondary memory was greater in unilingual than bilingual lists, and greater in bilingual than trilingual lists; 3) that recall of words in the language producing best recall under unilingual conditions was greatly impaired under bilingual and trilingual conditions, while recall of words in the language producing least unilingual recall suffered relatively little impairment

in bilingual and trilingual lists. Finally, the researchers noted that in recalling words from bilingual and trilingual lists, the subjects in the experiment tended to follow the recall of a word in one language more frequently with the recall of a word in the other or another language than with a word in the same language. Their findings simply corroborate the general conclusions recorded by Kintsch and Kintsch (1969) that semantic relationships between words in different languages influence tasks involving secondary memory, but not those involving primary memory. From the previous observations, one can document the following conclusions of the experiment: a) a multilingual person's different languages exist in relative isolation from each other; b) organization of list words into higher-order memory units is more difficult between different languages than within a single language; and c) lower recall of multilingual lists reflects reduced accessibility of information about list words.(21)

In his study of cerebral organization in bilinguals, Gordon (1980) discussed lateralization and commented on how the question of hemispheric dominance for semantic processing was less clear. It was noted how the right hemisphere contributed greatly to auditory comprehension and semantic processing but it did not contribute as much to phonetic or syntactic processing.Gordon reinforced the fact that in his study there was evidence that the right hemisphere contributed to semantic processing thereby playing a vital role in the manner in which information is stored in memory.(22)

In addition to experiments on the function of semantic memory in bilinguals, other researchers have developed a dual-coding model of language and cognition. Paivio and Desrochers (1980) explained

the essential features of this model by proposing a theoretical framework for aspects of bilingual memory and performance which had been considered in relative isolation from each other. There are three systems: the two verbal symbolic systems that underlie the bilingual's two languages and a third (image)system responsible for processing information about nonverbal objects and events. A principal feature of the systems is that they are able to function independently. They can interact because of interconnections that permit one system to initiate activity in another. Knowledge of the world is represented in the image system which is connected to both verbal systems. Representations corresponding to translation equivalents serve to interconnect the verbal systems; this allows for one-to-one relations as compared to the one-to-many relations that characterize the associative networks within each language system.(23) Only research can test the validity of the premises upon which the model has been constructed.

An attempt has been made to discuss semantic theory, its relation to comprehension, the nature and function of semantic memory and what some researchers have learned with respect to semantic memory and bilinguals. The findings of investigators briefly discussed in this paper seem to confirm the following general observations regarding semantic memory and bilinguals: (1) there is integration and storage of semantic information from various modalities in memory; (2) one semantic memory exists in bilinguals with labels from each of the language systems; (3) the preferred processing strategies of early bilinguals for verbal stimuli are analytic, semantic; (4) vocabulary items from

different languages are closely and automatically connected in semantic memory and the bilingual can turn off his nonactive language; (5) bilinguals process semantic memory information in the same way in their two languages in the same manner as monolinguals; and (6) semantic relationships between words in different languages influence tasks involving secondary memory. Semantic memory in bilinguals still remains an interesting and exciting topic for research, and investigators have just begun to explore its mysteries.

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